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Thought and Body. An activity of Logic in primary school.

Nicla Palladino^a, Nicolina Pastena^{b*}

^a*Dipartimento di Matematica e Informatica, University of Palermo, Via Archirafi 34, 90123 Palermo, Italy*

^b*Department of Human, Philosophical and Educational Science, University of Salerno, Via Giovanni Paolo II 132, 84084 Fisciano (SA), Italy*

Abstract

In the recent decades, the pedagogical debate has been formerly traversed by the emergence and then by the assertion of a matured awareness on the importance of the psychomotor skills in the educational- didactic path. The interpretive bio-psycho-social matrix has today become one of the pivotal points on which the educational-didactic activity rests and develops for the training of child's personality in its full motor, mental, perceptual, emotional, sensory development. Pedagogues, educators, and training professionals are increasingly confident that, since the birth, children are sensitive to the stimuli and to the environmental intervention, therefore it's essential to know their growth allowing them to express their potential at the maximum possible level. Essential was the contribution given by Jean Le Boulch, who considering the individual in his entirety, stresses the importance of affectivity in the path of a motor, logical-communicative, psycho-physical maturity of the child (Le Boulch 2010).

This guarantees the full functional development and the acquisition of a corporeal awareness, which is basic and indispensable, both in the path of space-time orientation and in the path of logical-conceptual acquisition. Within this theoretical framework, it has been thought of a teaching proposal which would combine all the highlighted points for a project that will promote the development of language and logical thinking. The project is addressed to pupils in the first classes of the primary school. The proposed subjects, directly recall the functions above mentioned. If we consider language and motion as instruments of thought, we suggest activities meant to supply children with a rich endowment which define certain aspects and elements of the surrounding and everyday actions.

These activities will also translate emotion and perceptions in words. A child should be educated to communicate his experiences following the space and time landmarks, to describe objects, people and events. One should promote activities that help to organize logically events and circumstances. The path is articulated in different points:

1. (First step of corporeal involvement) pupils altogether start to walk following a prearranged course; teacher, illustrating what they can see around, underlines certain points and objects.
2. The second step occurs in the classroom: during a collective discussion, pupils will decide the benchmarks which will help them to recreate the path. Teacher's role will be to stimulate the discussion through questions on the features of the references chosen by pupils and on the features that don't belong to them.

* Nicolina Pastena. Tel.: 00393339374588; fax: 00390974830120.
E-mail address: npastena@unisa.it

3. The third step consists in the representation of references as drawings which will be reproduced in their description with affirmative and negative sentences; other questions will stimulate their perception of the body in a three-dimensional context. The questions could be: was the object at your right or at your left? In that point, have we turned to the right or to the left? Was that object before or after the other?

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1. Psychomotor skills and learning between biology and didactic

The necessity of identify an epistemological framework which is able to validate and corroborate the importance of motor skills and corporeality in motion in the processes of knowledge's acquisition, represents a recent requirement. Only during the '70 in Italy developed the idea of the importance of using curricular models based upon psycho-motor, socio-motor and psycho-kinetic dynamics in the educational processes of young generations.

However, the close relationship between the corporeal reality and the educational processes has deep and consolidated roots in the human history (though many philosophers and scholars strongly criticized motor and recreational activities.) Plato, for example, makes Socrates say in the *Major Alcibiades* that "[...] man is what uses the body [...]. And what else employs the body if not his soul?" (Mari, 2007).

This point of view has for a long time contributed to foment a superficial and reductive idea of corporeality, mostly linked with the aesthetic standards, ignoring the concept of motion as a means of learning and as a vehicle for the establishment of social relationship.

In this perspective, the most significant functions of a human person as: language, learning, expressivity, understanding, affectivity were rigorously separated from the body, which was considered a material element through which this functions showed themselves (Gomez Paloma, 2004).

By the end of nineteenth century, a complex movement of studies started to develop and they demonstrate as certain aspects of the personality were closely related with it.

It's only with the phenomenology of perception by Merleau Ponty that it was possible to emphasize the importance of the body as a "permanent referent" of every human activity and as a "biological principle of his presence in the world" (Merleau Ponty, 2003).

For Husserl, for example, the logic is "theory of theories". It is not only a logical discourse on logic, but a meta-discourse on the logic, which, however, is not presented as a speculative superstructure(Husserl, 1996).

2. Can we "do logic" walking?

This is what we wonder about when we started to structure this project of experimental type, based on conversations we had with Italian teachers of preschool and primary school.

Today, logic seem to have an hard role in the teaching of elementary mathematics and the reasons derive from many factors.

The aim of the work is not to establish the reasons why this field of the mathematics is not appreciated by teachers and pupils, but it is to find a method for starting to give the first concepts of elementary logic both stimulating teachers to go ahead educating, and pupils' curiosity and interest through those concepts which are the objects of study analyzed in the following years.

The basis of propositional logic are part of a logical education that rather than being an object of explicit and formalized teaching, it should be subject of reflection and continuous care of teachers, who have to promote and stimulate the cognitive development of the child, promptly discovering possible problems or deficiencies.

Particular attention will be paid to the conquest of accuracy and completeness of the language, considering that especially in the first years of school, the natural language has an expressive richness and logical potentiality adequate to the necessity of learning.

Teachers will propose, from the beginning, on the level of experience and concrete manipulation, activities rich in logical potentiality which will be employ for arithmetic, geometry, sciences, language, etc. Among the aims of the first two years of primary school, we include:

- To classify objects, figures, numbers... according to a given fact and vice versa , to indicate an attribute which can explain the given classification.
- To identify, in problematic and concrete context and in those very simple, all possible cases of combinations of objects and attributes.
- Discover and verbalize regularity and rhythms in a given successions of objects, images, sounds and conversely to follow rules - proposed orally or in writing – for constructing these successions.
- To represent with elementary schemes (for examples with arrows) spatial-temporal sequences, relations of order , correspondences related to concrete situations.

Therefore It seems to be necessary to conduct an experimentation, which could induce to the comprehension (and at a later time to the representation and formalization) of the main element of propositional logic, drawing directly on the context of everyday life or on situations which children knows well.

As we thought to structured the project: the first step is corporeal involvement. This provide that the teacher has planned an exploratory exit, which can occur nearby the school building, or in the interior space of the school, as long as they are suitable for fixing various and different benchmark.

Teacher will guide pupils in a predefined path, making them to focus constantly on the action they are performing. For example, near the white little house all children have turned to the left, or near the big green bare tree everyone went straight .

The question is to establish the characteristics of the objects that one met and remember the activities carried out in connection with them.

The second step takes place in the classroom: during a collective debate, pupils will establish again the points of reference, on which the teacher made them to focus on, in order to reconstruct the path done. Teachers will stimulate the debate with questions on the characteristics of the references chosen by them and on the features which do not belong to them.

Moreover it is possible to go further, choosing the representation of references as drawings to reproduce.

A proposition is an assertion which expresses the value of the truth, in other words if an assertion it's true or false. For example:

- “Five is an odd number”;
- “Rome is the capital of France”.

They are two propositions (one true the other false).

Conversely, the assertion “I would like to pass the exam without studying” is not a proposition (it expresses a desire, is not something true or false).

Propositions may be combined to construct pro-position more complex using connectives as “and”, “or”, “not”, “if... then”, etc.

In the phase of description of some given references, children are encouraged to describe the objects they observed with all affirmative sentences; later, the description will be conducted using all negative sentences. The first reflection on which we can linger is that the above mentioned little house is white but at the same time it isn't red, yellow, green... In this manner they start to understand the meaning of “proposition” and what means that proposition is true or false.

If it is true that “the little house where we have turned to the right is white”, then all the other sentences will be false as “the little house where we have turned to the right is red” or “the little house where we have turned to the right is yellow”.

The graphic representation of the identified objects can allow a facilitation and a schematization of all these information. Near the draw will be inserted all true sentences which describe it but false sentences will be excluded.

Another type of questions will stimulate the children perception of their body in a tridimensional context.

For example: have we met the little white house on our right or our left?

Near the little white house, have we turned to the right or to the left? Is the little house located before or after the tree?

These considerations are all connected with the movement that children have performed and they can still be organized in true or false propositions.

Indeed human body has a rich symbolic structure and a special aptitude to the training/ exercise (Gomez Paloma, 2013). The physical body which experiments, it becomes a symbolic body and therefore a “logic mathematical body”. Movements become gestures, signs, symbols, codes alternating the symbolic-representative functions of reality.

In this perspective, learning logic through the body is pivotal for the development of a creative life style and for a productive thinking which is emerging and divergent.

So children can easily learn logic if it is presented in a playful form: in this way they wonder about the “why” and the “reasons” of the different experiences done and they discover and learn having fun in the same time (Pesci, 1991).

It is possible to create schemes as the followings:

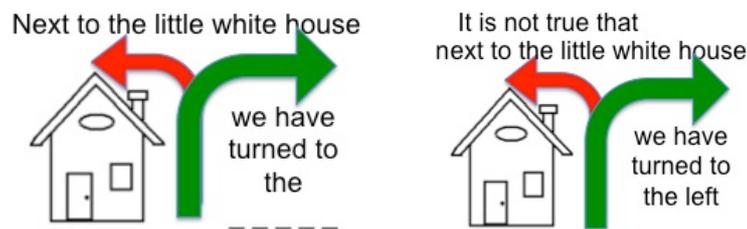


Fig. 1. Pictures for “true” and “false”.

The concept of propositional logic that we want to reach is the negation of a proposition.

If it is true that the little house was white, so it is not true that the little house was red.

If it is true that we have turned to the right near the little house, so it is not true that we have turned to the left near the little house. What is not true is defined with the term “False”.

Also in this case, some drawings related to the corporeal action may help children to internalize the concept associated to the action.

Since the first years of life, children create systems of logical operations based on the objects (not yet on the proposition in itself) organizing groups, classes, sets and relations through the handling.

This first group of operation does not concern completely the logic of classes or the logic of relations, establishing only some elementary structures of the groups.

We have realized that some operations, as for example the classifications, are relatively independent from the verbal language since they are defined starting from motor experiences and before of being operations of thought they are operations in the strict sense.

Therefore operations are coordination of actions, handlings of objects: then, language will be able to extend their expansions giving more mobility and universality to the conceptual articulation.

So the basis is the sensorimotor intelligence in which we have elementary and practical coordination.

Transitivity at the level of actions constitutes functionally what will be, at representative level, a serial relationships’ transitivity of topological grouping and inclusion of classes. A conjunction is a compound sentence formed by joining two statements with the word “and”. A conjunction is true only when both parts are true.

We start from the premise that Logic is not innate but it becomes necessary at a certain level and therefore it should be learned.

It mainly appears to the infant in the form of operating structure (acting on himself, on stuffs, on and with the others); the foundation of operative structures and the gradual advancement of the concept of reversibility, allow the processing of constants (preservation concept).

When a child is almost five years old he is able to create Logic and concrete operative structures (for example the conservation of quantities). (Piaget 1974)

Operations are not yet based on propositions or verbal definition but on the same objects grouped and classified in correspondence.

However, this concrete operation, though starting from the action, they already form reversible structures of thought (before applicable to the quantity of matter and then to the weight and volume). When a child is almost nine he will be able to base the logic of proportions on verbal definitions (hypothesis) and no more just on the objects: child will be able to find systematic methods of grouping objects according to all possible combinations and it will be created a structure of four transformation (Klein's group). So if the action intervenes structuring logical operations, it is also necessary to recognize the function of the social factor in the foundation of this structure.

The individual handling it will be gradually structured in different specific codes.

If this correspond to the truth, we can reputedly think about going beyond, coming to a more complex concept which usually is not faced by primary classes, namely" that of Implication". Conditional logic is the kind of deductive logic in which a key role is played by conditional statements, that is statements of the "if-then" form. For example, "If we meet the green tree, then will go back ".

A conditional statement is a statement with a hypothesis and a conclusion. When a conditional statement is written in if-then form, the hypothesis is the "if" part and the conclusion is the "then" part ($A \rightarrow B$). The converse of a conditional statement is found by switching the hypothesis and the conclusion ($B \rightarrow A$). The inverse of a conditional statement is found by negating both the hypothesis and the conclusion of the statement ($\neg A \rightarrow \neg B$). The contrapositive of a conditional statement is found by negating both the hypothesis and conclusion of the converse ($\neg B \rightarrow \neg A$). If the original statement is true, the contrapositive is also true. If the original statement is false, the contrapositive is also false. This means that a conditional statement and the contrapositive are logically equivalent.

In the same way, the converse of a statement and the inverse of a statement are logically equivalent.

If to the original conditional ("If we met the green tree, then we go back") we added instead the assertion that we do not go back, then it would follow that we have not met the big green tree. This sort of move we have called contraposition. If to the original conditional we added instead the assertion that "we go back", it would not necessarily follow that "we have met the green tree". To think otherwise is to commit the fallacy of conversion. If to the original conditional we added instead the assertion that the "we do not have met the green tree", then it would not necessarily follow that the "we do not go back". To think otherwise is to commit what we call the fallacy of inversion.

Due to the consecutive actions, it is possible to plan, before the walking, what children should do when they will met certain determined references.

For example with a map teachers can decide that when pupils met the green tree, they have to go back. Moreover they can establish that as soon as children met the white house they will turn on the right. In other words teachers give a series of instructions which are the consequence of what is possible to encounter during the explorative walking.

So now they can give the meaning of "implication", of "necessary condition" etc.

Returning in class, they reconstruct the experience discussing all together; furthermore it is also possible to place the "actions", represented by drawings or by sentences written on papers and cards in sequence. For example if the path presupposed that they had to go back when they met the green tree, then children would place the corresponding papers and cards in order to reconstruct the action done.

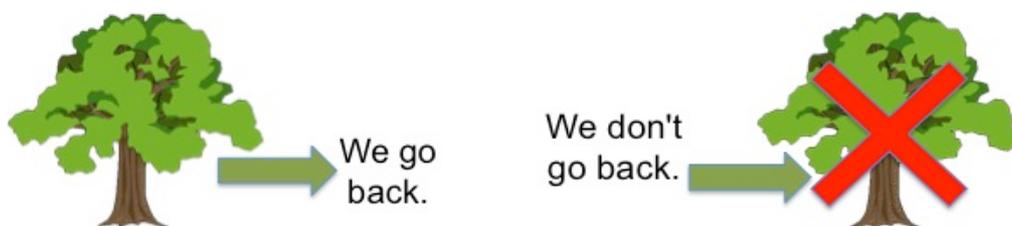


Fig. 2. Pictures for the conditional statement.

3. Conclusions

Every educational-didactic process takes a double meaning: on the one hand, the subject proceeds to the rationalization of his own physical and mental development (through the discovery, knowledge, awareness and organization of his existential reality) and on the other hand, he proceeds to the acceptance of ethical-social rules and to the expressive- communicative dynamics (Pastena, 2012).

Contemporary pedagogy rejects the idea of a fragmentary and fractioned education in different branches of knowledge,

Conversely it proposes a way to learn in constant interrelation through the unification of specific goals in one unique goal which turns out to be the complete growth and education of the person as a man and as a citizen.

In this sense, the current innovative discovery of the body, corporeality and physicality has undoubtedly thrown into crisis a vision of learning too focused on the philosophic criteria of Plato, Descartes, Leibniz and Hegel who focusing on the soul, on the thought, on the interiority and on the intellect had repeatedly stifled or reduced the corporeal dimension .

Human body has a rich symbolic structure and an extraordinary attitude towards education. So it proves that the body is not only mere matter: symbolism and culture are not material qualities and they do not belong to the material extension in itself. The physical body, in this sense, becomes also a symbolic body and, as consequence, a logical-mathematical body. Movements become actions, signs, symbols, codes, integrating with all the other human languages.

In this context, Learning logic acquired for the subject who studies a connotation of crucial importance for the personal education of a creative lifestyle and for an innovative divergent thinking.

It is on the basis of these considerations that we have undertaken this study proposing, on corroboration of what it is said before, to conduct soon an experiment on a large number of children in primary schools and to publish the results.

It is necessary to consider the reason of the increasingly obvious pupils' difficulties, which are both linguistic and logical:

- at the beginning of the educational cycle, children's language is characterized by an extreme poverty of words, which have generally broader and generic meanings;
- often children don't know the meaning of many words they use;
- language is not completely structured at all levels (lexical, syntactic and textual), communication is "noisy", its production is vague and ambiguous, so comprehension results very difficult .

Furthermore, at the beginning of secondary school, students highlights difficulties in the understanding of certain concepts and of logical languages using concept acquired in a strict way.

One of the reasons lies on the lack of "construction" of logical concepts, which are presumably treated superficially, in a sporadic way and poorly structured in primary school.

The didactic offer proposed by textbooks does not provide an organic learning process but it just participate in an improvised manner, being therefore not very effective.

The aim of the studies, here proposed, is to develop, since the first years of primary school, communication skills and logical languages which are abstract by nature and difficult to understand unless presented gradually, with references to concrete and very simple contexts.

Abstract and logical concepts should be introduced gradually through activities that consider the reality in which children live and their wealth of experience, allowing to present the first elements of language without ambiguity

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